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AUTHOR Larson, Carol S.; Greenfield, Patricia Marks
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ABSTRACT

The relationship between play unit complexity and the behavior of 24 normal 3- to 6-year-olds was examined in three Viennese kindergartens. Play units were rated as simple (a unit with one obvious use and no sub-parts or juxtaposition of two essentially different play materials, e.g., puzzles or clay), or super (a complex unit which has three or more play materials juxtaposed, e.g., blocks, cars, and plastic figures combined into one play unit). Results showed that play unit complexity is significantly related to play group size, degree of involvement, and amount of pleasurable affect exhibited in a child's play. Although all three kindergartens were crowded, results suggested that architectural design (i.e., the number of rooms in the kindergarten) affected the incidence of interrupted play. (Author/JMB)

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Physical Environment and Child Behavior in Vienna Kindergartens

Carol S. Larson

Patricia Marks Greenfield

University of California, Los Angeles

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Abstract

The relationship between play unit complexity and behavior of 24 normal 3-6 year-olds was examined in three Viennese Kindergartens. Results showed that play unit complexity is significantly related to play group size, degree of involvement, and amount of pleasurable affect exhibited in a child's play. Although all three kindergartens were crowded, results suggested that architectural design (i.e., the number of rooms in the Kindergarten) affected the incidence of interrupted play.

Playrooms can offer preschool children a wide range of equipment. Toys vary in many attributes: the skills they require, size, complexity, to name a few. Using the categories of complexity defined by Kritchevsky (1967; Kritchevsky, and Prescott, and Walling, 1969; Kritchevsky and Jones, 1972) this study sought to determine the effects of play unit complexity on five variables of play behavior. These variables, defined by Prescott, Kritchevsky, and Jones (1972) were: abortive play segments, length of complete activity segments, social structure, degree of involvement, and affect. We were also interested in whether boys and girls would respond similarly or differently to the environmental variable of play unit complexity. Our observations were made in three Viennese Kindergartens sponsored by the SPO, the Socialist Party of Austria.

In spite of the general consensus that toys are important for a child's development, little research has been conducted on what characteristics of play materials have what effects. Studies of the effects of toys on preschool children have been few in number and diverse in direction. Early studies like that of Hulson (1930), Van Alstyne (1932), Updegraff and Herbst (1933) compared particular play materials without trying to develop definitions of general characteristics which would correlate with behavior over a wide range of specific toys.

Shure (1963) made an important contribution in taking an ecological approach based on Barker and Wright's work (1954). She compared behavior in five different activity areas within a nursery school classroom. The five areas were used for art, books, dolls, games, and blocks. She found that mobility, participation, affect, constructiveness, and social

interaction varied from area to area. Mobility (number of movements in or out of an area) was greatest for the block area; participation relevant to an area was greatest for art; positive affect was greatest in the doll area; constructive use of materials was greatest in the book and art areas; while social interaction was greatest in the doll area. Although each area consists of an unspecified mixture of toys, these results indicate that different types of material encourage different types and quality of play behavior. Shure also found differential effects of play areas on boys and girls. For example, boys engaged in the most social interaction in the block area, girls in the doll area. This difference paralleled sex differences in area preference, for girls spent more time in the doll area, boys in the block area.

Only two studies of the effects of play equipment have appeared recently. In one, Farnham-Diggory and Ramsey (1971) discovered that children changed play units when these toys were defective but that this experience with defective materials had no significant effect on the child's persistence in subsequent play. The second study, by Busse, Ree, Gutride, Alexander, and Powell (1972), examined the effects of more or less play equipment on the cognitive and perceptual development of preschool children. Using a battery of tests to compare children who had been in differentially equipped school environments, they found both desirable and undesirable effects of more equipment. Unlike our study, however, there was no attempt to find out what kind of equipment produced what kind of effect.

In the domain of outdoor play, an early study by Johnson (1935) found an effect of amount of playground equipment on type of play and social behavior. More equipment was associated with more bodily

exercise, more play with materials, less social play, and less "undesirable" behavior (teasing, crying, hitting, etc.).

Kritchevsky (1967) developed a way of assessing outdoor space qualitatively; she found a large effect of space quality on teacher and child behavior: the higher the quality of the play yard, the more sensitive and friendly the teachers, the more interested and involved the children. This coding scheme was later extended to the indoor physical environment (Kritchevsky et al., 1969; Prescott, et al., 1972). Their results pertaining to the relationship between indoor physical space and child behavior are not yet available.

In the area of sex differences, they found that boys played alone more often than girls and showed more pleasurable affect, while girls showed more distress (Prescott, Jones, Kritchevsky, Milich, and Haselhock, 1973). The finding of more solitary play differs from that of Barnes (1971) who found no sex differences in the frequency of solitary play.

Our study concentrated on one aspect of the indoor physical environment-play unit complexity and looked at its effect on children's play in Viennese Kindergartens. Although we were not primarily interested in sex differences, we explored the possibility environment would have a differential effect on boys and girls.

METHOD

Experimental Design

SS served as their own controls in a repeated measures design in which each S's play behavior was observed until he had completed an activity segment (4 minutes or longer) at each type of play unit (level of complexity)--single, complex and super.

Subjects

Ss were 24 normal 4- and 5-year-olds attending one of three kindergartens in a working class district of Vienna. All three Kindergartens (termed nursery schools in the United States) were run by the Sozialistische Partei Österreichs and were therefore similar in educational philosophy. Eight children (4 boys and 4 girls) were observed at each kindergarten.*

Although all kindergartens were the same in terms of types of play units available, they did vary in density and number of rooms. Kindergarten I offered 11.1 sq. ft. per child (34 children in one room 18' x 21'). Kindergarten II had 9.8 sq. ft. per child (25 children in two rooms--13' x 13' and 7' x 11'). Kindergarten III had 12.9 sq. ft. per child (41 children in one room 22' x 24'). While all three kindergartens were, in an absolute sense, crowded, the three kindergartens are representative of the range of densities available in the crowded city of Vienna.

All three kindergartens were staffed by a single teacher. In two of the kindergartens another adult would occasionally enter the classroom to lead singing or help with a special craft project. All observations for this study were made when the primary teacher was the only adult present. Thus the adult-child ratio during the observations was highest for Kindergarten II and lowest for Kindergarten III. Kindergarten III lasted all day, while Kindergartens I and II had morning programs. All classes, however, were observed in the mornings, between 7:30 and 10:00 a.m.

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*Initially, 28 children were observed: 4 girls and 5 boys in Kindergarten I: 5 girls and 6 boys in Kindergarten II and 4 girls and 4 boys in Kindergarten III. However, to alleviate difficulties in computer analysis, 4 Ss were eliminated.

Procedure

All observations were made during periods of free play. Observation of a child began as he or she initiated play at a certain type of play unit. The only criteria influencing selection of children were (1) observation had to include the initiation of play at the unit and (2) the observations at each kindergarten had to be of four males and four females. The first child seen starting an activity in the room was observed until he or she had completed an activity segment (four minutes or longer) at each type of play unit being studied--simple, complex and super. The next child seen commencing an activity was then observed. This selection procedure was continued until the sample contained at least four boys and four girls.

The initial complete activity segments on each type of play unit were coded for the variables of size of play group, degree of involvement, affect and duration. An activity segment was defined as the period of continuous interaction around a play unit, lasting at least four minutes. All subsequent complete activity segments (ones observed at unit types for which the child had already been coded) and all abortive segments (when the child abandoned the play unit less than four minutes after he had initiated play there) were simply recorded noting times and unit type at which they occurred. These definitions of activity segments were based on those of Prescott, Kritchevsky, and Jones (1972).

Definitions of Play Units and Dependent Variables

Complexity of play units was also rated according to the criteria established by Prescott et al., (1972).

Simple units: a play unit that has one obvious use and does not have sub-parts or a juxtaposition of materials which enable a child to manipulate or improvise. (Examples used in this study: push/pull toy, chair, etc.)

Complex unit: a play unit with sub-parts or juxtaposition of two essentially different play materials which enable the child to manipulate or improvise. Also included in this category are single play materials and objects which encourage substantial improvisation and/or have a considerable element of unpredictability. (Examples: puzzles, clay, etc.)

Super unit: a complex unit which has one or more additional play materials, i.e., three or more play materials juxtaposed. (Examples: "play house" area--stove, dishes, dress-up clothes; when S combines blocks, cars, plastic figures into one play unit, etc.)

The basic coding for the dependent variables of size of play group, degree of involvement and affect was also extracted from the Prescott, Kritchevsky and Jones (1972) report and modified slightly. Size of play group was scored in this way: 1--child playing alone; 2--child playing with one other child; 3--child playing with at least two other children. For degree of involvement, each child was rated on a four-point scale: 1--continuously involved: seems oblivious to other activities and people in the room; 2--high involvement: concentration, 75% of the time; diversion, 25%; 3--moderate involvement: concentration, 50% of the time; 4--minimal involvement: concentration, 25% of the time. Evaluation of affect was coded according to overt behavior: 1--great pleasure, laughing, skipping, excitement, frequent smiling; 2--moderate pleasure,

occasional smiling; 3--neutral, no particular sign of pleasure or distress; 4--distress, frowns, crying, fights, anxious looks. The other two dependent variables were number of abortive activity segments observed and the length (in number of minutes) of the initial complete activity segments at each type of unit.

All observations were made by one observer. However, reliability was tested by having a second observer independently rate fifteen boys and fifteen girls at Bing Nursery School, Stanford, California. The resulting correlations between the two observers were as follows: unit type, $r = .95$; social structure, $r = .96$; degree of involvement, $r = .94$; affect, $r = .88$.

RESULTS

A three factor analysis of variance with one repeated measure (play unit type) was performed on all dependent variables. The three factors were play unit type, sex, and kindergarten. In order to correct for non-independence of the dependent variables where it existed, the number of degrees of freedom used in F-tests was reduced by half; this procedure yields very conservative estimates of significance levels.

Play Unit Type

Play unit type was significantly related to size of play group ($F = 5.22$, $df = 2, 36$; $p < .02$). Children at super units played more with other children than children at complex or simple units (Table 1).

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Insert Table 1 About Here

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T Tests for related samples showed significant differences between mean social structure complexity for simple and super units only ($t = 2.93$, $p < .01$).

TABLE 1

Mean Size of Play Group, Degree of Involvement, Level of Positive Affect, Length of Complete Activity Segments, and Number of Abortive Segments at Different Types of Play Unit

	Simple Unit	Complex Unit	Super Unit
Complexity of Social Structure (3 = most complex)	2.1	2.4	2.7
Degree of Involvement (1 = highest involvement)	3.3	2.6	2.1
Level of Positive Affect (1 = most pleasure)	3.0	2.4	2.1
Length of Complete Activity Segments (minutes)	9.5	17.1	12.9
Number of Abortive Segments	0.5	0.5	0.8

Type of play unit was also significantly related to degree of involvement (F = 11.90; df = 2, 18; $p < .001$). As Table 1 shows, the order of involvement was: super > complex > simple. Paired t-tests showed significant differences between the means for all three unit types: simple and complex (t = 4.34, $p < .001$); complex and super (t = 3.11, $p < .001$); simple and super (t = 6.06, $p < .001$).

Play unit was also related to the level of positive affect exhibited by the children (F = 4.66; df = 2, 36; $p < .001$). T-tests for matched pairs revealed that children's affect was significantly lower at simple units than at either complex units (t = 2.79, $p < .01$) or super units (t = 4.14, $p < .001$). Table 1 presents the mean level of positive affect for each type of play unit.

Finally, play unit type significantly affected the length of the complete activity segments (F = 5.40; df = 2, 36; $p < .01$). The shortest segments were at simple units (Table 1). Results of matched pair t-tests showed only one significant difference: between mean number of minutes at simple and complex play units (t = 2.22, $p < .05$). The mean number of abortive activity segments occurring at each type of play unit is presented in Table 1. Type of play unit did not have a significant effect on number of abortive segments.

Sex Differences

Play unit complexity did have one differential effect on boys and girls. Girls showed more abortive segments on simple units, whereas boys showed more abortive segments on complex and super units. The analysis of variance showed this interaction significant at the .05 level (df = 2, 36; F = 3.36). (The three-way analysis of variance revealed no other statistically significant interaction effects.)

Overall sex differences also appeared.

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Insert Table 2 About Here

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As Table 2 indicates, males showed higher levels of involvement than females ($F = 5.31$; $df = 2, 18$; $p < .05$). Sex also accounts for a significant amount of variance in level of positive affect observed ($F = 4.71$; $df = 1, 36$; $p < .05$); males overtly exhibited more pleasure than females (Table 2). Table 2 also shows mean social structure complexity, length of complete activity segments, and number of abortive segments for girls and boys; sex did not make a significant difference for these aspects of behavior.

Kindergartens

Each kindergarten's mean number of abortive segments per child was as follows: Kindergarten I = .92; Kindergarten II = .21; Kindergarten III = .62. The variance among the means was significant ($F = 4.16$; $df = 2, 36$; $p < .05$). T-tests for independent samples revealed that the significant difference in mean number of abortive play segments occurred between Kindergarten I and Kindergarten II ($t = 2.13$, $p < .05$). It is impossible to know for sure what factor or factors produced fewer abortive segments in Kindergarten I than Kindergarten II, but a possible explanation will be suggested in the Discussion section.

TABLE 2

Mean Complexity of Social Structure, Degree of Involvement, Level of Positive Affect, Length of Complete Activity Segments, and Number of Abortive Segments for Girls and Boys

	Girls	Boys
Complexity of Social Structure (3 = most complex)	2.3	2.5
Degree of Involvement (1 = highest involvement)	3.0	2.4
Level of Positive Affect (1 = most pleasure)	2.8	2.3
Length of Complete Activity Segments (minutes)	11.9	12.3
Number of Abortive Segments	0.6	0.6

DISCUSSION

This study shows that complexity of play units is closely related to children's play behavior. Group play occurs more at the highly complex super units while solitary play is more frequent at simple units. Increasing complexity increases the involvement or concentration of the child (super > complex > simple). This result shows that qualitative characteristics of the physical environment affect children's involvement in their play indoors as well as out, in Vienna as well as California (Kritchevsky, 1967). Children exhibit the lowest amount of pleasurable affect at simple units. Finally, complex units encourage the longest play activity.

This study found no significant sex differences with regard to social structure. Thus, our results agree more with Barnes (1971) than with the Pacific Oaks research. The discrepancy may stem from the difference between indoor and outdoor space. Because our study dealt only with indoor space, boys did not have as much opportunity to engage in solitary activity as they did in the Prescott, et al. (1973) study. Thus, in this study, boys probably played more in groups than they would have had they been on a large playground outdoors. (Barnes (1971) unfortunately does not report where children in his study were observed.)

Play unit type affected the extent of prematurely terminated play (number of abortive segments) differentially for boys and girls. Boys showed most of their abortive segments at super units whereas girls exhibited the most abortive segments at simple units. Simple units, by definition, are the most limited in the play behavior they elicit and the girls' trend is understandable. But why should boys show more abortive segments at super units? One possible explanation lies in the fact that

boys are generally found to be more aggressive than girls (e.g., Freedman, 1973) and aggression would be particularly disruptive at super units where group play predominates.

The explanation for the finding that number of abortive segments was lowest in Kindergarten II could relate to differences among teachers or in class composition. This seems unlikely, as there is no reason why these general factors would have caused this single isolated effect. Educational program is also an unlikely explanation as all three kindergartens were part of the same political organization and were therefore similar in this respect. Density of children is not the explanation as Kindergarten II was the most crowded of all (9.8 sq. ft. per child). Some other ecological factors suggest themselves. One is the absolute number of children, lowest in Kindergarten II (25, as opposed to 34 in Kindergarten I and 41 in Kindergarten III); this factor is correlated with teacher-child ratio in this study. Thus, Kindergarten II has the highest ratio. The other possibility is division of space into two rooms, unique to Kindergarten II. Let us examine each of these possible explanations. If the absolute number of children or teacher-child ratio were the crucial factor, then the largest difference in number of abortive segments should be between Kindergarten II, the smallest group, and Kindergarten III, the largest group. But this is not the case; the largest difference is between II, the smallest, and I, the medium-sized group. By elimination, then, division of space seems the most likely explanation. Since, of course, division of space must operate to reduce the size of effective face-to-face groups, these two explanations reduce to the same underlying factor. This line of argument agrees with Whiting's (1970) observation that increases in group size beyond a certain point result in individual

behavior requiring a prolonged attention span. It is interesting that the psychological effect of group size seems more dependent on spatial organization than on actual numbers or density. This conclusion is in line with Desor's finding that adults feel less crowded in a partitioned room than in a nonpartitioned room of the same area. With regard to density, Loo's (1972) study of the effect of density on preschool children found that density did not significantly increase the frequency of interrupted play.

Kindergarten II was the only one of the three which had two rooms. Although the rooms were not totally isolated from each other, visually or aurally, they did partially separate all occurring play activity into at least two loosely formed groups. Intrusion (physical, visual or aural) was thereby decreased. Probably for this reason, children in Kindergarten II rejected a play unit in less than four minutes significantly less frequently than those in Kindergarten I. The two rooms of Kindergarten II did not encourage isolated play (social structure did not vary across kindergartens) but the divided space apparently did reduce the amount of disruptive contact between the children. This factor of architectural design was more influential than the differences in density among the three crowded kindergartens.

Complex units encouraged the longest complete activity segments. In comparison with simple units, this is understandable; complex units provide the child with more possibilities for play than simple units do. But why don't super units, for the same reason, exceed complex units in length of complete activity segments? Two reasons seem valid. The first and probably most accurate explanation is that super units encourage group play and, in a crowded area, playing with many children can be frustrating;

trying to maintain play relationships is demanding when surrounded by other children involved with other play units. Second, the three kindergartens provided very few super units. The children often created their own. Examples of these were: using chairs as supports for bridges (blocks, plastic strips) and cars, imaginatively converting the entire room into the area for a train game or police chase, etc. Occasionally such creativity was unacceptable by the teacher and she interfered.

Play unit complexity is an important factor to consider when planning a playroom environment. Do you want to encourage group or individual play? Do you want the child to play with many different toys or stay with one for an extended period of time? The answers to these and other questions should influence the proportions of super, complex and simple play units present in the playroom.

Although our study was not designed to investigate the effect of density, numbers, and spatial layout on play, our results are most suggestive. Future research should systematically examine the effect of these variables. Spatial layout seems particularly important; neglected up to now, an understanding of its effects could lead to important advances in the design of educational environments for young children.

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